Things We Should Know When Designing Simulator-based Teaching in Difficult Airway Management

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In Taiwan, improving patient safety has been widely praised as a great movement in the reform of the health care system.[1] Developing guidelines, an important step in the application of medical knowledge to medical practice, is highly applauded as the cornerstone of achieving patient safety.[2] However, the quality of training programs and the methods of assessing the clinical performance of health care providers should meet current standards in all areas of medicine. For instance, the American Society of Anesthesiologists has updated the algorithm and guidelines in the management of difficult airways.[3] To secure the patient's airway in response to an emergency situation, the proper sequence of actions must be made in accordance with the updated algorithms. In accomplishing this action, team performance is known to be more vital than individual performance.

Direct observation of individual performance is the most valid method for assessing clinical competency. Labor-intensive and time-consuming, real-life assessment is particularly difficult during crisis management where it may endanger patient wellbeing.[4] Simulation, a substitute for direct observation, has been gaining in popularity over the past decade as an important educational intervention that can reduce the number of human errors and prevent adverse events.[5] It is also an instrument that can mimic an environment that is similar to a real-life situation in terms of appearance and behavior. The clinical conditions can be standardized, repeated, and videotaped for further evaluation.[6] More importantly, interventions can be repeated without jeopardizing the patient's life should mistakes be made. The *Anesthesia Simulation System* offers a realistic setting in the operation room or emergency department for individuals in training who work through a situation, either routine or rare, structured at the expected level of clinical competency.[7] Although board-certified anesthesiologists in Taiwan carry out most of the decision-making in anesthetic practice, they work in close collaboration with nurse anesthetists to protect patients against the risk of surgery. Without the beauty of this teamwork, patients receiving anesthesia are in hazardous condition during surgery.[8]

In this issue of the *Journal of the Chinese Medical Association*, Chen et al reported their experience with the systematic renewal of difficult airway management skills for nurse anesthetists and junior residents using "an instructor-based real-time multimedia medical simulation".[9] They found that this method was useful in updating the knowledge and skills of difficult airway management for many training participants. However, their results raised concerns in designing studies related to the assessment of clinical performance using simulator-based training. We should consider 2 important parts in such study design, i.e. types of simulator and tools of assessment of the clinical performance. These concerns are discussed below.

(1) Simulators were primarily used for anesthesia training in the early 1990s, whereas patient simulators today encompass numerous medical professions such as nursing, intensive care, and trauma.[10–13] Four types of simulators are available for health care education: simple (part task) and complex microsimulators, and simple and complex macrosimulators (full-scale simulators). Macrosimulators include a physical component, usually a mannequin, while microsimulators are purely computer-aided. Full-scale simulators are the ideal solution for all educational simulator training. However, each of the above simulators has different strengths and weaknesses in achieving the educational goals. Microsimulators are usually an important adjunct to macrosimulators. They provide practice and assessment of learning objectives at higher cognitive levels

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than traditional written tests or oral examinations. Knowledge and cognitive skills are required in an integrated manner to solve the computer-simulated cases. The learner is not only able to practice dealing with the more common conditions but also with rare events.[14]

High-fidelity simulation is believed to have potential application in medical education where a wide range of clinical experiences can be standardized and customized to the level of the learner's competency.[15] Students are encouraged to play an active role in their learning and confront problems in a risk-free environment where immediate feedback can be given. Performances can be measured on-site or afterwards using videotapes, which can identify discrepancies between expected and actual educational outcomes.

The simulator used in Chen et al's study was an essential type of integrated simulator incorporating audiovisual multimedia. A 4-hour curriculum of airway emergency was developed by the faculty, which consisted of a 2-hour didactical lecture (4 sections) and a 2-hour instructor-led simulation (4 technical skills). As demonstrated in other studies, the validity, either face or content, of the scenarios should be reviewed and endorsed by the committee or faculty members. They should be asked to identify critical performance items that a trainee would be expected to perform at their level of training.[16,17] Unfortunately, Chen et al do not emphasize this important reviewing process of their 4 scenarios.

(2) The action or sequence of actions in the operating room taken by anesthesiologists can be divided into technical and non-technical components. The latter is related to cognitive skills. To validate the scenarios suitable for assessing the technical aspects of performance, a valid scoring system should be used to measure different abilities associated with clinical performance. In addition, the reliability and validity of this assessment tool should be determined to show homogeneity.[16–20] Face validity defines that items of the scale actually assess what they should assess, while content validity ensures that the scale has items within the appropriate domains. Construct validity can be determined by comparing the performance of various groups of clinicians, where better performance in 1 group would be expected. Several lines of evidence reveal good agreement between raters when scoring simulator performance. For instance, Devitt et al[19] reported that raters yielded consistent scores when observing anesthesiologists at work under preset instructions. Gaba and DeAnda[10] and Morgan et al[16] also found acceptable interrater reliability in assessing the technical performance of anesthesiologists or medical students in simulator training courses. Extensive checklists have been used in various studies to score clinical performance of the individual in the simulator, which is found to be more objective. A global scoring system is well established as an appropriate way of measuring complex performance. A high level of agreement was found between judges in all categories, suggesting that this global rating scale is a more valid measure of performance than checklists at this level of competency.[21] The final challenge of designing a study associated with clinical performance using simulator-based teaching is to ensure that a quasiexperimental time series design is considered, i.e. pretest and posttest or even retest. However, none of the above mentioned points could be found in Chen et al's study. My personal view is that more thought should have been given by the investigators to the assessment design in simulator-based teaching.

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